

Notice of Allowability

Application No.

10/697,320

Applicant(s)

PYO ET AL.

Examiner

Belur V Keshavan

Art Unit

2825

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 10/31/2003.
2. ☒ The allowed claim(s) is/are 1.
3. ☒ The drawings filed on 31 October 2003 are accepted by the Examiner.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☒ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☒ Certified copies of the priority documents have been received in Application No. 10/156,839.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08),
Paper No./Mail Date 10/31/2003
4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

DETAILED ACTION

EXAMINER'S AMENDMENT

Authorization for this examiner's amendment was given in a telephone interview with Mr. Matt Shanely (Reg. No. 47,074) on September 27, 2004.

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

The application has been amended as follows:

To Specification

On page 1, in paragraph [0001] line 1, delete " co-pending".

On page 1, in paragraph [0001] line 2, enter after "2002," --now US Patent No. 6,664,636--

On page 14, in paragraph [36] line 6, substitute "19" with --29--.

To Claim

In claim 1, line 6 on page 27, substitute "iodine (I)" with --residues--.

Allowable Subject Matter

Claim 1 is allowed.

Examiner's Statement As To The Reasons For Allowance

The following is an examiner's statement of reasons for allowance:

The primary reason for the allowance of claim 1 is inclusion therein, in combination as currently claimed of the limitation of a method of deposition of copper film for a semiconductor device.

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The limitation found in claim 1 is neither disclosed nor taught by the prior art of record alone or in combination.

The limitation found in claim 1 comprises inter alia the following limitation:

Performing steps before and after a plurality of wafer processes with a load lock of a copper film deposition equipment; aligning a wafer in a aligner of the equipment in a desired position; removing residue on a surface of the wafer in a de-gas and in-situ annealing chamber; positioning the wafer in and out of chambers for the wafer processes with a feeding chamber having a robot; cleaning an inside and an outside of a pattern using plasma on the wafer in a pre-cleaning chamber; depositing a barrier metal on the pre-cleaned wafer in a barrier metal deposition chamber; preparing the barrier metal prior to depositing a copper thin film thereon with a first preparation process wherein the preparation of the barrier metal includes either an adhesion glue layer flash copper deposition chamber depositing flash copper on the barrier metal or a chemical enhancer treatment chamber processing an equal chemical enhancer adsorption before depositing the copper thin film on the barrier metal; preparing the wafer with a second preparation process including either a CECVD deposition chamber equally processing chemical enhancer and depositing CVD copper thin film on the wafer where flash copper is deposited or a CVD copper deposition chamber depositing the copper thin film on the entire surface of the wafer treated with chemical enhancer and treating the wafer with a plasma in a plasma treatment chamber to remove residues produced on the surface of copper thin film.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue

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fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

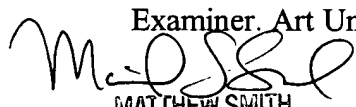
Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Belur V Keshavan whose telephone number is 571-272-1894. The examiner can normally be reached on 8-4:30 Monday to Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew S Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

BVK. *BK*
September 22, 2004.

Belur V. Keshavan.
Examiner, Art Unit 2825.

MATTHEW SMITH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800